

ECR Spring-Symposium 2026

## Chirality and Broken Symmetry in Thin Film and Interfacial Systems - Maß-less vs. Maß-ive Phases

Joined event of GraCE, IRTG@CRC1277 and GRK 2905

**Organizer:** Elizaveta Andriyakhina (GraCE, FU Berlin)

**Local organization:** Arpan Das, Prof.in Laura Manelyte-Aldehni (GraCE, U Regensburg)

**Venue and date:** Regensburg Center of Ultrafast Nanoscopy, May 22nd, 2026

**Structure 30+15:** 30min Presentation, 15min Q&A

8:30-8:45 Coffee, get together

8:45 - 9:30 Gal Lemut (FU Berlin, **GraCE**)

**Title:** Proximity-Induced Superconductivity in Chiral Antiferromagnets

**Abstract:** Recent experiments on the chiral kagome antiferromagnet  $\text{Mn}_2\text{Ge}$  have provided strong evidence of proximity-induced spin-polarized superconductivity. We introduce and explore a minimal model that exhibits a rich phase diagram as a function of chemical potential and spin canting. We find a valley-singlet superconducting phase for parameters consistent with the experimental system. This phase transitions into a Chern insulator at larger canting and gives rise to topological superconducting phases with Chern numbers  $C_{\text{BdG}} = \pm 1, \pm 3$  at other chemical potentials. Our results show that proximity-induced superconductivity in kagome antiferromagnets is a promising route towards exotic superconductivity with spin-polarized Cooper pairs, with potential applications in spintronics.


9:30 - 10:15 Johanna Zijderveld (TU Delft)

**Title:** Non-local Transport Spectroscopy of Symmetry-Broken Phases in Bilayer Graphene

**Abstract:** Interaction-driven phases in Bernal bilayer graphene provide a platform where correlated states can be tuned using electric fields alone. Understanding the resulting phase diagram is the focus of intense theoretical and experimental effort. However, directly comparing theory and experiment remains challenging, as existing probes of valley symmetry breaking rely on local microscopy techniques that are incompatible with double-gated device geometries. Here, we propose a non-local tunnel spectroscopy approach to distinguish symmetry-broken phases using transport measurements alone. An interacting region is coupled to external quantum dots that act as symmetry-selective probes. The interacting region is treated self-consistently using Hartree-Fock theory and embedded into a transport setup. We demonstrate how the mean-field order parameters can be recovered directly from transport signatures.

10:30- 10:45 Coffee (Coffee has no academic degree, so it gets less time.)





10:45 - 11:30 Adam Chaou (Donostia International Physics Center)

**Title:** Exciton Insulators in Quantum Hall Bilayers

**Abstract:** Recent experiments on electron-hole bilayers in transition metal dichalcogenides reveal a tunable competition between excitonic condensation and quantum Hall order driven by band gap variation. We develop a dipole description of electron-hole pairs in a quantizing magnetic field, establishing a mapping to quantum Hall bilayers and elucidating the role of interlayer coherence. We derive the charge-texture correspondence and compute the superfluid stiffness, identifying the conditions under which the excitonic condensate remains robust against quantum Hall competing orders.

11:30 - 12:15 Elizaveta Andriyakhina (FU Berlin, **GraCE**)

**Title:** Ignition of Spin-Triplet Supercurrent in an S/F/S Josephson Junction

**Abstract:** We develop a theory of ballistic junctions with a uniformly precessing ferromagnetic or half-metallic interlayer and show that magnetic dynamics generate spin-polarized triplet superconducting correlations in both N/F/S and S/F/S geometries. For the N/F/S structure, we show that precession induces equal-spin Andreev reflection and a long-ranged spin-polarized proximity amplitude. In the half-metal limit, where subgap transport is absent without precession, the zero-bias conductance becomes finite only due to the drive and exhibits resonant enhancement under ferromagnetic resonance.

For the S/F/S junction, we demonstrate that the same mechanism produces a dc Josephson current of spin-polarized triplet origin. In the half-metal limit, the junction is effectively off for static magnetization but switches on once the magnetization precesses, while for a ferromagnetic interlayer the precession-induced contribution remains long-ranged and survives averaging over junction length. In the experimentally relevant small-angle limit, the induced Josephson current is approximately sinusoidal in phase, and its critical value scales quadratically with the precession angle, identifying microwave-driven magnetization dynamics as a practical route to controllable, nanosecond switching of triplet superconducting transport.

12:45 - Lunch at Dult